TRACE ELEMENT CHEMISTRY OF LARKMAN NUNATUK (LAR) 12011, A NEW OLIVINE-PHYRIC SHERGOTTITE.

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Introduction: The olivine-phyric shergottite LAR12011 was found at Larkman Nunatuk during the 2012 ANSMET expedition [1]. The preliminary analysis of LAR12011 presented in [1] and oxygen isotope analysis in [2] confirms its Martian origin. This new sample is paired with LAR06319 [1-3]. Here, we present petrography and new data on the trace element chemistry of LAR12011.

Methods: We obtained sections LAR12011 ,19 and LAR12011 ,20 from the JSC Meteorite Working Group. Petrography was examined by optical transmitted and reflected light microscopy and with a ZEISS 1550 VP FESEM. Major mineral compositions were determined with a Cameca SX 100 and a JEOL JXA-8200 electron microprobe. Trace element analysis for individual minerals was performed by secondary ion mass spectrometry using a CAMECA IMS 7f-GEO ion microprobe.

Results and discussion: General petrography, mineral chemistry and shock features of LAR12011 have been previously described by [2-4] and are similar to LAR06319 as in [5]. We find similar results in our examination. New observations from our study include shock lamellae in pyroxene laths and shock divitrification of pyroxene. Raman analysis of maskelynite shows that plagioclase was subject to shock above 29.4 GPa, when compared with experimental shock data from [6].

Trace element chemistry: Pyroxene patterns are generally enriched in HREEs with negative Eu anomalies. As calcium content increases from core to rim, concentration of REEs generally increases and Eu anomalies decrease slightly. As plagioclase begins crystallization, pyroxene becomes relatively more depleted in LREEs and Eu anomaly increases.

Maskelynite patterns are enriched in LREEs with strong positive Eu anomalies. Sodium-rich maskelynite is more enriched in HREEs, and has a larger Eu anomaly.

Phosphates are the main carrier of the REEs, as in LAR06319 [5, 7]. Merrilite and apatite have flat REE patterns and negative Eu anomalies. This is consistent with late stage crystallization. Overall, REE patterns are consistent with expected fractionation from the crystallization history.

The REE pattern for the melt inclusions in the olivine megacrysts match the whole rock data [8]. The melt inclusion data also matches parent melt compositions, calculated with coefficients in [9]. The sample has few cumulates of olivine, and most olivines are likely phenocrysts. The melt inclusion and whole rock data also matches LAR06319 as given by [5].

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